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Title: FY 1959 USNRDL SHORE STATION DEVELOPMENT PROGRAM

Serial No: 3-1410-22/A1

Pages: 25

Notes: NRDL

A1-2
3-1410-60/A1
JDP:lps

OCT 13 1956

From: Commanding Officer and Director
To: Commander, San Francisco Naval Shipyard

Subj: Fiscal Year 1959 USNRDL Shore Station Development Program; submission of

Ref: (a) NAVSHIPS Instruction 11010.8B of 15 June 1956

Encl: (1) FY 1959 USNRDL Shore Station Development Program(20 copies)

1. Enclosure (1) is forwarded to be consolidated with the San Francisco Naval Shipyard Shore Station Development Program for annual submission as directed by reference (a).

RICHARD S. MANDELKORN

A. O. DEWITT
By direction

12ND-MI 4589 (Rev. 1-54) *NAVY-MI-DPPO12ND

Code	3-1410	3-140S					
Reviewed by							
Date	11/13	11/13					

Initials hereon indicates that the person initialing has read and approved the correspondence and has no recommendation to make as to change therein.

U. S. NAVAL RADIOLOGICAL DEFENSE LABORATORY
SAN FRANCISCO 24, CALIFORNIA

3-1111D-27
JIO:lps
15 Nov 1956

FISCAL YEAR 1959 SHORE STATION DEVELOPMENT PROGRAM

SECTION I. INSTALLATION DATA

1. Name: U. S. Naval Radiological Defense Laboratory
   Tenant Activity of the San Francisco Naval Shipyard
2. Location: San Francisco 24, California
3. Installation Control Number: 3865-825
4. Nearest City: San Francisco, California
5. County: San Francisco, California
6. Management Bureau: Bureau of Ships
7. Naval District: Twelfth
8. Principal Function or Product: Research and development laboratory
9. - -
10. Year of Initial Occupancy: 1946
11. Status: Active

SECTION II. MISSION

MISSION: To conduct basic and applied research on the physical and biological effects of hazardous nuclear and thermal radiations, including interrelated effects of such shock or blast and the dispersion and contaminating effects of fission products resulting from an atomic explosion or from controlled nuclear processes; develop and evaluate radiac devices and shielding equipment or materials for protection of personnel, reclamation or decontamination procedures for shipboard, aircraft, and land areas; preparation of data for training information required by the military services, including assistance to other federal agencies and government contractors in the fields of atomic and radiological warfare; and develop the use of radioisotope and other tracer techniques in the above technological fields.

SECTION III. PERSONNEL

PERSONNEL	OFF	EM	CIV	STUDENTS Off	STUDENTS Em	SUPPORTED Off	SUPPORTED Em	TOTAL
1. Present	33	44	509	-	-	-	-	586
2. Planned End FY '59	35	47	570	-	-	-	-	652
3. Ultimate End FY '62	40	52	850	-	-	-	-	942

ASECTION IV. INVENTORY

1. The U. S. Naval Radiological Defense Laboratory is a tenant activity of the San Francisco Naval Shipyard. SFNS inventory includes that used by USNRDL.

SECTION V INSTALLATION CONSTRUCTION PROGRAM

Facility Class & Construction Category			Physical Capacity				Cost to Gov't (in thous $)		
Category Code No.	ITEM - TITLE	Unit of Measure	Inventory as of 30 Jun '56	Addit'l Capacity Required	Prior Auth. Outstanding 30 Jun '56	New Auth. Requested	Estimated cost of Required Facilities	Prior Auth. Outstanding 30 Jun '56	New Auth. Requested
310	Neutron-electron Gamma Radiation Facility 12ND 1090	Each	0	1	0	1	2,000	0	2,000
860	Relocation of SFNS Railroad Marshalling Yard 12ND 1106	-	-	-	0	1	265	0	265
310	Animal Breeding, Holding and Experimental Facility 12ND 1135 Rev.	Each	1	0	0	1	1,000	0	1,000
310	10,000 Curie, Cobalt 60 Facility 12ND 1312	"	0	1	0	1	265	0	265

SHORE STATION DEVELOPMENT PROGRAM, FY 1959

ITEM JUSTIFICATION DATA

U. S. Naval Radiological Defense Laboratory, San Francisco 24, California

Neutron-electron Gamma Radiation Facility, 12ND 1090

Primary Category Code: 310

Proposed Authorization: $2,000,000

Proposed Appropriation: 2,000,000

SECTION I. ITEM DESCRIPTION

1. Type of construction: Permanent

2. Type of Facility: New

3. Type of design: Special design

4. Physical Characteristics:

   a. Shape of building: Irregular

   b. Length in ft.: Var

   c. Width in ft.: Var

   d. Number of stories: Two

   e. Gross area: 13,000

   f. Gross cube: 320,000

   g. Number of buildings: Three

   h. Heating: Yes

   i. Cooling: Yes

   j. Capacity -

   k. Other

5. Brief Description: This item consists of 3 components, each housed in a separate building. Component A is a high flux neutron source capable of a yield of 10^{14} neutrons per second housed in a building of approximately 7,000 sq. ft. Component B is a high energy electron gamma source capable of producing gamma fluxes of at least 100,000 roentgens per hour at a distance of 1 meter from the target under study at 20 MEV energy, housed in a building of approximately 3,000 sq. ft. Component C is a low energy electron gamma source designed to operate from 1 to 5 MEV and produce a minimum gamma flux at 20,000 roentgens per hour at a distance of 1 meter from the target at top energy level, housed in a building of approximately 3,000 sq. ft.

SECTION II. COST ESTIMATES

Component A - High Flux Neutron Component

Code	Category Title	Unit	Quantity	Unit Cost	($ In thous.) Est.Cost
Primary					
310	R&D and Test Buildings	SF	6,500	40	260
Collateral					
310	R&D and Test Buildings			LS	520
Secondary					
812	Electrical Distribution			LS	16
822	Heat, Steam Transmission			LS	40
832	Sewage Lines			LS	1
842	Water Distribution System			LS	1
852	Sidewalks and other pavements			LS	1
890	Miscellaneous Utilities			LS	1
		Sub-total			840

NEUTRON-ELECTRON GAMMA RADIATION FACILITY (cont'd)

Component B - High Energy Electron-Gamma Component

Code		Unit	Quantity	Unit Cost	(In thou $) Est. Cost
Primary					
310	R&D and Test Buildings	SF	4,200	40	168
Collateral					
310	R&D and Test Buildings			LS	472
Secondary					
812	Electrical Distribution			LS	16
822	Heat, Steam Transmission			LS	40
832	Sewage Lines			LS	1
842	Water Distribution			LS	1
852	Sidewalks and other pavements			LS	1
890	Misc Utilities			LS	1
			Sub-total		700

Component C - Low Energy Electron Gamma Component

Primary					
310	R&D and Test Buildings	SF	4,200	40	165
Collateral					
310	R&D and Test Buildings			LS	263
Secondary					
812	Electrical Distribution			LS	8
822	Heat, Steam Transmission			LS	20
832	Sewage Lines			LS	1
842	Water Distribution			LS	1
852	Sidewalks and other pavements			LS	1
890	Misc Utilities			LS	1
			Sub-total		460
			GRAND TOTAL		2,000

Costs are based on station estimates.

SECTION III BASIS OF REQUIREMENT

1. Quantity required: 1
2. a. Total existing quantity: 0
   b. Quantity sub-standard: 0
   c. Net existing quantity: 0
3. Construction or accomplishment underway or scheduled: 0
4. Quantity deficient: 1
5. Related items: SFNS Land Excavation and Fill, 1st Increment, 12ND 682

6. Requirement: The Laboratory needs facilities to generate nuclear radiation of the various types and relative intensities that occur in nuclear detonation, under controlled conditions in order to determine the characteristics and effects and carry out other functions of the mission. The existing 2 MEV Van de Graaff, the only controlled radiation source at the Laboratory, is unable to meet the total need because (1) its capabilities are limited to relatively low level, (2) a large amount of much needed radiation time is lost in changing over from one type of radiation to another, and (3) the Laboratory program needs far more radiation time than this facility can furnish, even with extensive overtime. The proposed facility will (1) provide higher intensity radiation, (2) provide additional sources and (3) place the existing Van de Graaff at better advantage by eliminating the frequent changeovers. If approval of this project is delayed, a vital part of the Laboratory program will be delayed and the scientific talent will not be utilized to best advantage. The early development of countermeasures against nuclear warfare, which is so urgently needed for military and civilian defense is dependent on this facility.

7. This project is located on Navy-owned property.

NEUTRON-ELECTRON GAMMA RADIATION FACILITY - 12ND 1090
COMPONENTS "A", "B" and "C"

I REQUIREMENT

The USNRDL urgently requires a "neutron-electron gamma radiation facility" to conduct basic and applied research and development in the field of radiological defense and in other related areas of radiation effects for the Armed Services and the Defense Department. The development of thermo-nuclear weapons has created a new field of extremely urgent importance to National Defense and military preparedness. New and immediate studies of effects and the development of tactical countermeasures against the effects of blast, heat and lethal ionizing radiation of great magnitude and residual to both nuclear and thermo-nuclear weapons, is necessary. The earliest possible development of countermeasures is both a military and Civil Defense necessity

The "neutron-electron gamma radiation facility" will be used for the investigation of effects of neutron and gamma ray radiations on physical, chemical and biological materials and processes. Laboratory reproduction and time scaled simulation of radiological phenomenon resulting from the explosion of nuclear and thermo-nuclear weapons but under controlled conditions is necessary and within the capability of the "neutron-electron gamma radiation facility".

Type, size of beam and mode of operation, and range of energy level required are not available in a single system suitable for Laboratory needs.

The requirement for a "high flux neutron source", Component "A", is for versatility in supplying neutrons of variable and controlled energy with at least 10^{14} neutrons per second total output.

The requirement for a "high energy electron gamma source", Component "B" , is for versatility in controlled variation of energy level, beam flux and target heat dissipation within approximately 3 to 21 MEV energy and exposure time from micro-seconds to hours duration.

The requirement for a "low energy electron gamma source", Component "C" , is for versatility and controlled variation of both energy level and intensity of beam from 1 MEV lower energy level to upper level of 5 MEV energy.

The three component system will be effectively and economically utilized by scheduling the employment of each of the systems on multiple projects requiring these types of radiation, range of energies and intensities.

It is not considered technically feasible of design or economical operationally to provide housing for the three components, "A", "B" and "C", in a single structure due to radiation interference factors, interaction between and variation in power supply requirements.

The "neutron-electron gamma radiation facility" will not become obsolescent in the foreseeable future and is needed immediately in order to meet the already scheduled and planned Scientific Program requirements for radiation research investigation. The new USNRDL laboratory building, #815,

NEUTRON-ELECTRON GAMMA RADIATION FACILITY - 12ND 1090
COMPONENTS "A", "B" and "C"
(cont'd)

now complete and being occupied, provides for the consolidation of the Laboratory into excellent general laboratory facilities and environment but the building design does not provide for major controlled radiation facilities. Radiation facilities cannot be incorporated into Building 815 due to hazards to personnel, space and design limitations.

The building requirements for housing the "neutron-electron gamma radiation facility" are based on estimated physical proportions and operational factors of the three components, "A", "B" and "C". Building structures will be high strength steel frame capable of supporting crane ways and traveling cranes over the entire equipment area. Siding and roof panels will be of suitable prefabricated material capable of easy attachment and removal thereby making possible alteration to openings and ease of access as necessary. The floor strength in all spaces must be capable of carrying at least 1000 pounds per square foot floor loading in order to support the equipment and a concentrated load of cement block or lead target shielding. Electric powered push-button controlled overhead cranes of no less than five -ton capacity are required in each equipment room for handling equipment components, target fixtures and portable shielding structures. All access doors to the equipment and target rooms must be shielded and electrically interlocked with the control circuits for the operation of the equipment. General building requirements include adequate and equipped laboratory work space, controlled temperature and humidity air-conditioning systems for selected spaces, interior communications system, breakdown alarm, fire protection, security flood lighting and fencing outside, and other necessary and conventional features.

The total estimated power requirement is approximately 1500 KVA full operational load supplied from 11,000 Volt, AC, primary utility line, assuming zero point eight-tenths (0.8) power factor and including a better than fifty percent over-demand factor to insure good regulation. Each component requires both AC and DC power of different characteristics. A central, local emergency power system is required of approximately 100 KVA, suitably interlocked and automatic to carry the essential services load of all three components in the event of a main power failure.

II PROJECT DESCRIPTION

The "neutron-electron gamma radiation facility" is comprised of 3 components:

Component A - High Flux Neutron Source. The high flux neutron component is used as a source of neutrons for bombarding various materials including biological specimens, to study the effects from exposure to a high density neutron field. It is necessary to obtain a total neutron yield 10^{14} neutrons per second. The high neutron field flux is necessary to the study of nuclear reactions pertaining to fission fragment spectra, weapons detection, decay rate schemes and measurement of nuclear cross-sections. The advent of thermo-nuclear weapons has put additional emphasis on the neutron hazard problem. In addition, the development of shipboard reactors has re-emphasized the necessity for better understanding of the effects of high density neutron fields.

Component B - High Energy Electron Gamma Source. This system will produce both beta and gamma spectra. It is necessary that the high energy system produce gamma fluxes of at least 100,000 roentgens per hour at a distance of 1 meter from the target under study at 20 mEV energy. The equipment design most favorable to satisfying this requirement is described as a "linear accelerator". The system is high voltage - electronic in principle.

NEUTRON-ELECTRON GAMMA RADIATION FACILITY - 12ND 1090
COMPONENTS "A", "B" and "C"
(cont'd)

Beginning with a high voltage high flux electron emitter, an electron beam is directed along the axis of a magnetic focusing field and in a high vacuum. Thus focused and accelerated to a high velocity, the beam is directed through a terminal window in the linear accelerating vacuum tube ultimately impinging on the target complex resulting in the production of gamma rays.

Component "C" - Low Energy Electron Gamma Source. The low energy system must operate at 1 MEV and up to 5 MEV and produce a minimum gamma flux of 20,000 roentgens per hour at a distance of 1 meter from the target under study at 5 MEV upper energy level. This system may be of the Van de Graaff type accelerator.

The exact engineering parameters for the design of each component, "A", "B" and "C", of the "neutron-electron gamma radiation facility" are, at present, under study. Due to the general lack of demand for utility radiation facilities at this time, there are no "packaged" systems available. Therefore, the "neutron-electron gamma radiation facility" must be virtually custom designed due to its specialized nature and only after exhaustive engineering investigation in order to assure the maximum utility satisfactory to the scientific needs of the USNRDL.

III PROJECT ANALYSIS

The U. S. Naval Radiological Defense Laboratory is unique in that no other laboratory has been established for the primary purpose of studying the effects of atomic weapons and obtaining the information necessary to the development of countermeasures. The personnel and mode of operational scientific research at the USNRDL is unique in that investigators of nuclear effects and related physical sciences and in medical and biological sciences work as one integrated team in execution of the Laboratory mission. The geographic location of the USNRDL is favorable in many ways. The location of the site and new laboratory facilities near the boundary of the San Francisco Naval Shipyard insures effective logistical support from a large, firmly established Naval Activity. Regionally, the USNRDL situation among some of the most highly recognized academic institutions in the Nation, which are themselves engaged in scientific research, is fortunate from the standpoint of scientific and technical personnel relationships, recruitment and insuring continuing professional development.

Scientific personnel at the USNRDL are unique in their qualifications. Many mature, highly trained and widely recognized scientists who are members of the scientific staff prefer, by choice, affiliation with the USNRDL due to the importance of the Laboratory mission; the integrated multi-science team concept of research operations; the collaborative association with other distinguished scientists; the opportunity for full and satisfying contributions to science and the National Defense. In consideration of these and other important factors the USNRDL can, with adequate and appropriate facilities' support, keep abreast and maintain its lead in fulfilling its mission toward national preparedness and defense against atomic and thermo-nuclear weapons and, at the same time, make important incidental contributions to the advance of peacetime applications of nuclear science in biology, medicine and industrial enterprise.

New and continuing investigations in the USNRDL Scientific Program which are planned and supported jointly by Army, Navy, Air Force and other agencies in the Defense Department urgently require the use of radiation facilities. During August 1954, in order to avoid undue duplication in the field of research and development in radiological defense and related radiation effects, the Department of the Army agreed to a joint Army-Navy Program at the

NEUTRON-ELECTRON GAMMA RADIATION FACILITY - 12ND 1090
COMPONENTS "A", "B" and "C"
(cont'd)

USNRDL equally responsive to the needs of the Army and the Navy. In September 1954, the U. S. Air Force stated its concurrence in the principles embodied in the agreement between the Army and the Navy, and confirmed its intention to continue to utilize the USNRDL services in this field.

The existing controlled radiation source at USNRDL is a 2 MEV Van de Graaff accelerator. This accelerator is used continuously for a wide variety of studies in the physical, chemical and biological fields. Due to the limited capacity of this accelerator considerable delay and lost time is imposed on urgently important projects. When necessary to change the mode of operation of the present Van de Graaff to or from positive ion to gamma, periods of interruption of from 10 to 15 days are experienced. Hence, by eliminating the need for frequent and costly change-over the "neutron-electron gamma radiation facility", in addition to directly supporting the Laboratory program, will also substantially enhance the value and return from the existing accelerator. When operated in conjunction with the "neutron-electron gamma radiation facility", the Van de Graaff accelerator will be a useful supplementary facility for many years.

The present needs for other radiation sources are in part satisfied by contract with the University of California, Berkeley, and the Stanford Research Institute, Palo Alto, for use of their facilities. This is becoming a progressively expensive procedure in project delay, investigator manpower and in direct cost. In addition, capacity time available to USNRDL for use of radiation facilities is diminishing because of expansion and acceleration of research programs at both institutions, together with the increasing needs of the USNRDL. The effectiveness of using these facilities is limited due to distances from USNRDL; the complications involved in moving sensitive instruments and specimens, especially biological specimens, to and from these facilities; and ineffective employment of high calibre investigator manpower because of lost time involved.

Examples of research work urgently requiring a "neutron-electron gamma radiation facility" are:

1. Investigation of effects of neutron and gamma radiation upon the organic physiology of mammals from which extrapolation may be made for determining the effects on the human being. This involves the use of large numbers of mammals maintained in controlled isolated colonies and environment while under study. These controlled biological specimens are very sensitive to environmental changes and represent while under study, a considerable investment in investigator manpower, time and money.

2. Study of fission reactions and nuclear processes from which estimates of energy and decay rates may be made of various types, and under various conditions, of nuclear weapon explosions. Information derived from these studies made under laboratory controlled conditions is of urgent necessity in the development of countermeasures. Weapons field tests provide, at present, a source of this type of data. Such tests however, do not provide the desired controlled conditions necessary to timely and accurate investigation. The cost of participation in field tests is unreasonably excessive for the return, both in manpower and in equipment and material.

NEUTRON-ELECTRON GAMMA RADIATION FACILITY - 12ND 1090
COMPONENTS "A", "B" and "C"
(cont'd)

3. Investigation of physical, chemical, mechanical and electrical properties of materials when subjected to neutron and gamma irradiation. These studies lead to the accurate and timely selection of engineering materials in the course of countermeasures development, personnel protective measures and industrial processes.

4. Investigation and evaluation of neutron and gamma radiation hazards and suitable shielding systems of military significance. Studies of this nature are also of urgent significance to both the U. S. Public Health Service and the Federal Civil Defense Administration.

5. Development and evaluation of radiac detection and survey instruments and radiation dosimetry for the monitoring and measurement of radiation spectra and energy, and for the protection of personnel under controlled conditions in the presence of any radiation hazard.

The urgent and rapidly expanding research program at the USNRDL is sponsored by the Bureau of Ships, the Bureau of Medicine and Surgery, the Bureau of Aeronautics, the Bureau of Supplies and Accounts, the Bureau of Yards and Docks, and the Office of Naval Research, Navy Department; also, Department of the Army, Department of the Air Force, Atomic Energy Commission, and the Armed Forces Special Weapons Project.

Acquisition of additional land area will not be required for this facility.

The "neutron-electron gamma radiation facility" appears on the USNRDL Master Shore Station Development Plan approved jointly by USNRDL and the San Francisco Naval Shipyard Shore Station Development Board.

U. S. NAVAL RADIOLOGICAL DEFENSE LABORATORY
SAN FRANCISCO 24, CALIFORNIA

15 November 1956

SHORE STATION DEVELOPMENT PROGRAM, FY 1959

ITEM JUSTIFICATION DATA

U. S. Naval Radiological Defense Laboratory, San Francisco 24, California

Relocation of San Francisco Naval Shipyard Railroad Marshalling Yard - 12ND 1106

Primary Category Code: 860

Proposed Authorization: $265,000

Proposed Appropriation: $265,000

SECTION I. ITEM DESCRIPTION

1. Type of construction: Permanent

2. Type of Facility: Alteration

3. Type of design: Special design

4. Physical Characteristics:

   a. Shape of building: NA

   b. Length in feet: NA

   c. Width in feet: NA

   d. Number of stories: NA

   e. Gross area: NA

   f. Gross cube: NA

   g. Number of buildings: NA

   h. Heating: NA

   i. Cooling: NA

   j. Capacity: NA

   k. Other: -

5. Brief Description: Relocate the SFNS Railroad Marshalling Yard out of the USNRDL area . This consists of removal, relocation and relaying 8,600 linear feet of railroad approximetely 400 feet southwest and roughly parallel to its present alignment.

SECTION II. COST ESTIMATES

Code		Unit	Quantity	Unit Cost	(In thou $) Est. Cost
Primary					
860 a.	Remove existing track	FT	8,800	5.30	47
860 b.	Relay existing track(new ties)	FT	8,250	11.20	93
860 c.	Remove existing turnouts	EA	16	734.00	12
860 d.	Install existing turnouts	EA	15	1,469.00	22
860 e.	Level existing site	SY	23,000	.37	8
860 f.	Prepare subgrade(new site)	SY	30,000	.29	9
860 g.	Ballast, in place	T	10,200	4.28	44
860 h.	Red rock fill	T	9,200	3.06	30
				TOTAL	265

SECTION III. BASIS OF REQUIREMENT

1. Quantity required: 1
2. a. Total existing quantity: 1
   b. Quantity sub-standard: 0
   c. Net existing quantity: 1
3. Construction or accomplishment underway or scheduled: 0
4. Quantity deficient: 0
5. Related items: Animal Breeding, Holding and Experimental Facility - 12ND 1135

6. Requirement:

The SFNS Railroad Marshalling Yard divides the Laboratory area into two parts, and the proposed animal facility - 12ND 1135 will be located on the side opposite from the main building. It is necessary to move the Marshalling Yard out of the Laboratory area (1) to permit orderly and economical development of new facilities including the animal facility, (2) for ease, safety and economy in movement of personnel and materials between buildings in the conduct of work, and (3) provide more effective security at less cost. If this project is not provided, approximately 3,300 linear feet of additional security fencing and a personnel overcrossing or bridge will be required for access to the proposed animal facility area at an estimated cost of $65,000. In addition, the interfering separation will retard progress of experimental work and increase operating costs due to delays in movement of personnel, supplies, and experimental animals in the various stages of progress. The increased operating cost alone has been estimated at approximately $60,000 per annum, which in itself would amortize the railroad relocation expense in five years.

7. This project is located on Navy-owned property.

RELOCATION OF RAILROAD MARSHALLING YARD - 12ND 1106

I REQUIREMENT

The SFNS Railroad Marshalling Yard divides the U. S. Naval Radiological Defense Laboratory area into two parts, and the proposed animal facility - 12ND 1135 will be located on the side opposite from the main building (Building 815). It is necessary to move the Marshalling Yard out of the Laboratory area, (1) to permit orderly and economical development of new facilities, including the new animal facility, (2) for ease, safety and economy in the movement of personnel and materials across the present Marshalling Yard location, and (3) to provide more effective security. This project is needed concurrently with the Animal Breeding, Holding and Experimental Facility - 12ND 1135 in order that proper security can be maintained on occupancy without excessive fencing expense.

II PROJECT DESCRIPTION

This project consists of the removal, relocation and relaying of 8600 linear feet of existing standard gauge railroad yard trackage, approximately 400 feet south and roughly parallel to the present alignment as shown on the Station Development Plan. All existing track materials, including switches, rail, rail connections and other suitable material, will be used wherever feasible. The relocation of this railroad yard will provide approximately 400,000 sq. ft. of land area contiguous to the land area already occupied by the USNRDL facilities.

III PROJECT ANALYSIS

This project provides for the relocation of the San Francisco Naval Shipyard Marshalling Yard to permit consolidation of the U. S. Naval Radiological Defense Laboratory facilities into a contiguous and integrated working area; and it is necessary for security, safety and economy of operations. The planned development of USNRDL is based on use of the land lying between Crisp Avenue and Palou Avenue for construction of the proposed animal facility - 12ND 1135 and other facilities. In order to make use of the USNRDL area as now divided by the SFNS Marshalling Yard, 3300 linear feet of extra heavy duty security fencing and the construction of a personnel overcrossing or bridge would be required at an estimated cost of $65,000. Such an interfering separation would result in increased operating costs, due to delays to personnel, transportation of supplies, and the shifting of critical experiments in various stages of progress which are estimated at approximately $60,000 per annum. This cost alone would amortize the expense of relocating the Marshalling Yard in less than five years.

This project is located on Navy-owned property and appears on the USNRDL Master Shore Station Development Plan approved jointly by USNRDL and the San Francisco Naval Shipyard Shore Station Development Board.

SHORE STATION DEVELOPMENT PROGRAM, FISCAL YEAR 1959

ITEM JUSTIFICATION DATA

Date: 15 November 1956

U. S. Naval Radiological Defense Laboratory, San Francisco, California

Animal Breeding, Holding and Experimental Facility - 12ND 1135

Primary Category Code: 310

Proposed Authorization: $1,000,000

Proposed Appropriation: 1,000,000

SECTION I. ITEM DESCRIPTION

1. Type of Construction - Permanent

2. Type of Facility - Replacement

3. Type of Design - Special design

4. Physical Characteristics:

a.	Shape of building	-
b.	Length in feet	-
c.	Width in feet	-
d.	No. of stories	2 and 1
e.	Gross area	31,400 sq. ft.
f.	Gross cube	500,000 cu. ft.
g.	Number of buildings	3
h.	Heating	Yes
i.	Cooling	Yes
j.	Capacity	-
k.	Other	

5. Brief Description:

Component A is a central breeding, holding and experimental facility, 2-story, 24,000 sq. ft. vermin proof and fire resistive; air conditioned and with all possible built-in features to guard against spread of disease among experimental animals which are especially bred to be sensitive. Component B is a dog kennel attached to Component A. It consists of a 7000 sq. ft. building with winter heating divided into 100 single dog enclosures, aisles, and 2 rooms with space for 25 dog cages in each, and 100 individual outdoor runs. Component C is a separate incinerator and crematory building of 400 sq. ft. for disposal of animals and animal waste, with safety features and ash recovery means for analysis.

ANIMAL BREEDING, HOLDING AND EXPERIMENTAL FACILITY
(cont'd)

SECTION II. COST ESTIMATES

Component A - Main Structure

Code	Category Title	Unit	Quantity	Unit Cost	$ (In thous) Ext. Cost
Primary					
310	R&D and Test Building	SF	24,000	21-	504
Collateral					
310	R&D and Test Building	LS			300
Secondary					
812	Electricity service	LS			12
822	Heat, steam service	LF	300	60-	17
824	Heat, gas service	LF	300	3.35	1
832	Sewer lines	LF	200	10-	2
842	Water lines	LS			5
850	Roads and streets	LS			4
452	Lumber storage - relocation	LS			14
				Sub-total	859

Component B - Kennels

Code	Category Title	Unit	Quantity	Unit Cost	$ (In thous) Est. Cost
Primary					
310	R&D and Test Building	SF	7,000	12-	84
Collateral					
310	R&D and Test Building	LS			5
				Sub-total	89

Component C - Incinerator and Crematory

Code	Category Title	Unit	Quantity	Unit Cost	$ (In thous) Est. Cost
Primary					
310	R&D and Test Building	SF	400	100-	40
Collateral					
310	R&D and Test Building	LS			10
Secondary					
800	Utilities and ground improvements	LS			2
				Sub-total	52
				GRAND TOTAL	1,000

Costs are based on station estimates.

SECTION III. BASIS OF REQUIREMENT

1. Quantity Required - 1
2. a. Total existing quantity - 1
   b. Quantity sub-standard - 1
   c. Net existing quantity - 0
3. Construction or accomplishment underway or scheduled - 0
4. Quantity deficient - 1
5. Related items - SFNS Relocation of Marshalling Yard, 12ND 1106

6. Requirement for item and effect if not provided.

The present Biological-Medical Program requires more and higher quality experimental animals than can be supplied by the present facility at Building 707 for biological studies in the effects of nuclear detonation and processes. Approximately 3,000 additional animals per month will be required in the near future for more extensive studies of the effects of neutron radiation, which has recently been determined as an urgent need by the Army, Navy and Air Force. Animals for experimental use are provided by the laboratory animal facility, Building 707 mainly, and from outside sources as much as is available. The present facility is overcrowded for present needs; it does not provide adequate isolation to prevent spread of disease and it gets wet in the winter with the result that animals develop pneumonia. The temporary type construction and earth settlement damage prevent exclusion of excessive moisture. The general construction prevents adequate cleanliness and the sterile isolation needed in

ANIMAL BREEDING, HOLDING AND EXPERIMENTAL FACILITY
(cont'd)

laboratory experimental work. If the new facility is not provided, the research program will be limited to the present facility output and runs the risk of a serious setback if an epidemic occurs. A new facility is needed to measure and analyze the internal contamination of people (and animals) who have been exposed to fallout from nuclear detonation and aerosals.

ANIMAL BREEDING, HOLDING AND EXPERIMENTAL FACILITY - 12ND 1135

I REQUIREMENT

The USNRDL urgently requires an animal holding and breeding facility for the production and holding, under finely controlled environmental conditions, a large variety and a large number of mammals, in order to carry out that part of the USNRDL mission calling for:- "basic and applied research on the physical and biological effects of hazardous nuclear and thermal radiations", investigation of systemic and biological effects of thermal, neutron and gamma radiations upon the organic physiology of mammals, from which extrapolation may be made for determining the effects on the human beings. This involves the use of large numbers and a variety of mammals maintained in controlled and isolated colonies under finely controlled environmental conditions. These controlled biological specimens are extremely sensitive to environmental conditions and therefore must be protected from all casual extremes while under study since they represent a considerable investment in research progress, investigator manpower and initial cost. The development of thermo-nuclear weapons has created a new field of extremely urgent importance to National Defense and military preparedness. New and immediate studies of biological effects and the development of tactical countermeasures against the effects of heat and lethal ionizing radiations of great magnitude and residual to both nuclear and thermo-nuclear weapons, are necessary. In the field of biological radiation research the urgent objectivity of the USNRDL program may also yield early incidental results of significance for peacetime use in the atomic energy field generally.

Animals for experimental use are provided approximately 95 percent by the Laboratory animal facility and the remainder by outside sources.

Outside sources have been able to furnish only limited numbers of animals of mediocre purity of strain and such animals are used at present to the maximum feasible extent. The present animal facility, Bldg. 707, is overcrowded for present needs. Due to earth settlement, ground moisture conditions, and temporary type construction, there is a serious animal health problem in the winter, with pneumonia developing in the animals due to excess moisture. The animal feed frequently mildews before use, causing feed waste and occasional animal sickness due to spoiled food. Bldg. 707 was originally created as an early expedient in support of a weapons test field operation and was therefore constructed as a temporary facility only. It has been used continuously for more than five years at great risk and restriction to the USNRDL Bio-Medical Program, due to the general inadequacy of the facility. The present facility is situated in the SFNS and occupies critical land area. Concurrent and in conformance with the SFNS Master Shore Station Development Plan, this facility must be relocated to conform to the SFNS planned development in FY 1959 from the area it now occupies.

The new permanent USNRDL, Building 815, is not designed, nor is it suitable, to house animal breeding, holding and disposal facilities. Although some animal rooms are provided in Bldg 815, they are clinical laboratories and therefore not suited to house breeding, holding and disposal facilities. Infection and epidemic control demand a separate facility for breeding and holding experimental animals. The building requirements for the animal holding and breeding facility are based on experience factors to date in using animals for controlled experiments in the field of bio-medicine and on present and projected program requirements for bio-medical research at USNRDL. Recently, all branches of the Armed Services have indicated that additional information in the effects of neutron radiation is needed, and additional study programs to meet this need will require progressively more animals.

A low level radiation detector and spectographic analyzer facility is needed in studies to determine the internal contamination of persons (and d laboratory animals) who have been exposed to fallout from nuclear detonations and aerosols from nuclear reactions. More precise information regarding the amounts, types, and eventual accumulation locations within the anatomy of radioactive contamination is of vital importance in the determination of effects

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and development of countermeasures. Housing space and shielding is needed for a 1 MEV X-ray machine which is temporarily installed in Building 510A in order to vacate the SFNS' buildings in accordance with the Master Shore Station Development Plan.

II. PROJECT DESCRIPTION

Component A - Central Facility. The central animal breeding, holding and experimental facility will be a two-story, high strength reinforced concrete structure of 24,000 sq. ft. floor area. The building will be vermin-proof and fire-resistive construction and will be provided with all utilities. Construction will be typical veterinary and biological laboratory, with rounded corner tile or magnecite floors and wainscot. Floors will be sloped and provided with adequate drains, and washdown water connections will be provided. Rooms will have a 10' ceiling height with metal lath and plaster ceiling and upper walls. Plaster in dog areas will be sound absorbent type. Extra wide door openings are required, 5 ft. wide in cage washing and feed rooms and 4 ft. wide in all other animals rooms. All general lighting and convenience outlets will be vapor proof type; in the surgery room explosion proof electrical work will be required and other hospital operating room explosion safeguards will be provided. Complete air conditioning is required, including filters, ventilation, heating and cooling, and humidity control, with drafts held to a minimum. Re-circulation between rooms is not permitted. Separate room temperature control to 2 F adjustable from 60 to 80 F, and humidity control adjustable from 20 percent to 80 percent is desired. An emergency heating means is required for the rat and mouse colony rooms in the event of failure of the air conditioning system or steam supply. Rat and mouse colony rooms shall be specially equipped to provide a sterile environment and sterile feed. Design for general floor loading of 200 pounds per square foot and 400 pounds per sq. ft. in the storage room is required and a freight elevator of 4,000 lbs. capacity is required. A low level radiation detector and spectographic analyzer facility is required, consisting of (1) a shielded enclosure with enclosed detection instruments in which test speciman will be placed for analysis, (2) an operating room which will house instrumentation and controls, (3) a speciman preparation and holding area, and (4) a chemistry laboratory. An enclosure and shielding is required for a 1 MEV X-ray unit which is temporarily located in Building 510A.

Following is a tabulation of approximate specific area requirements:

1.	Enclosure and shielding for 1 MEV X-ray Unit 20'x30'(full bldg height)	11.	Rat Holding Room 400 Sq. ft.
2.	Office and record room 150 sq.ft.	12	Mouse " " 400 " "
3.	Laboratory 150 " "	13.	Dog holding (4 rooms) 1,500 " "
4.	Kitchen 100 " "	14.	Dog ward (sick) 250 " "
5.	Cage sterilizer 600 " "	15.	Monkey 400 " "
6.	Storage (food and cage) 600 " "	16.	Hamster 350 " "
7.	Walk-in refrigerator 200 " "	17.	Rabbit 400 " "
8.	House breeding colony (3 rooms) 2,000 " "	18.	Guinea pig 250 " "
9.	Rat " " " 3,000	19.	Surgery room 200 " "
10.	Isolation rooms (3) 700	20.	Low level radiation detector and spectographic analyzer facility 2,000 " "
		21.	Locker rooms, heads, halls, service rooms, etc.

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Component B - Kennel. A kennel is required to house 150 dogs, 100 with individual enclosures and outdoor runs, and two rooms with space for 25 dog cages in each room. The kennel will be adjacent to and accessible from the central facility. The kennel will consist of a one-story reinforced concrete building of approximately 7,000 sq. ft., 10' ceiling, with windows and exposed joist, non-combustible roof structure. Sloping floors with adequate drain and washdown connections are required. Floor and wainscot covering of tile or magnecite are desired for ease of cleaning. Minimum lighting and convenience outlets are required. Winter heating to 70 F is required. Fenced outdoor runs are required adjacent to indoor enclosures, with sloping concrete deck, drainage and washdown facilities, and with wire enclosure. Each indoor run shall be 6 ft. x 6 ft. and each outdoor run shall be 6 ft. x 10 ft. Each animal run shall be separated solid from adjacent runs up to 4 ft. high to prevent spread of disease. Hallways 6 ft. wide are required. Fencing for outdoor runs shall be 7 ft. high and 2 runs shall have top wire covering.

Component C - Incinerator and Crematory. An incinerator and crematory building of approximately 400 sq. ft. is required in the vicinity of but not adjacent to the central facility Component A. A reinforced concrete structure mounted on a concrete slab, provided with floor drain and washdown connection is required. Incinerator and crematory units should be separate, each gas fired. The incinerator should be large enough to dispose of 200 lbs. of animal waste and papers per day. The crematory should be large enough to hold carcasses 5 ft. long by 3 ft. wide by 2 ft. high and constructed with adequate means of recovering all ash for analysis purposes. Means will be provided for the control of flue ash, odors, toxic aerosal and gases. Necessary utilities and safety features for the protection of personnel are required.

III PROJECT ANALYSIS:

The new animal facility will improve the quality of bio-medical research results by improving the quality of the basic tool which is animals.

The proposed animal facility is needed to produce animals for research work of the following nature:

a. Investigation of effects of neutron and gamma radiation upon the organic physiology of mammals from which extrapolation may be made for determining the effects on the human being. This involves the use of large numbers of mammals maintained in controlled isolated colonies and environment while under study. These controlled biological specimens are very sensitive to environmental changes and represent, while under study, a considerable investment in investigator manpower, time and money.

b. Investigation and evaluation of neutron and gamma radiation hazards and suitable shielding systems of military significance. Studies of this nature are also of urgent significance to both the U. S. Public Health Service and the Federal Civil Defense Administration.

c. The scope of bio-medical research and investigation necessary in the carrying out of the USNRDL mission is extensive. The urgency is obvious since the objectives lead to protection of personnel against radiation hazards. A few specific and general areas of investigation significant of the magnitude of this field are:

1. Beta radiation effects on skin.
2. Effects of neutrons on physiological systems. Irradiation dosage measurements and post irradiation protection.

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3. Post-irradiation recovery of physiological systems.
4. The effects of whole body irradiation on antibody formation including delayed immune response to tetanus toxoid and studies on post-irradiation infection.
5. Post-irradiation effects, delayed effects and protection criteria against repetitive exposure of the circulatory, respiratory and digestive systems.
6. Post-irradiation infection studies on the entire organic physiological system including specialized investigation of individual parts, i.e., the blood, the bone, various tissue and all components thereof.
7. Effects of ionizing radiations on metabolism and nutrition.
8. Effects of environmental stress and psychological behaviour studies during and post irradiation.
9. Combined systemic and bio-chemical effects of burns.

In conjunction with animal holding and breeding, a new facility is needed to accurately measure and analyze internal radioactive contamination within a living or dead biological speciman. More precise information is needed, such as (1) which materials within the body become radioactive following neutron irradiation, and (2) locations within the anatomy where radioactive material tends to accumulate. Such information is of extreme inportance in the development of countermeasures. In addition, such a facility would be extremely useful in many other far reaching biological studies, as well as determination of radiation effects on materials.

The present Bio-Medical Program uses approximately 6,000 new animals per month of several types and is continually holding approximately 18,000 animals which are in progress of experiment. This utilizes 100% of the present animal facility capacity. The present program could be accelerated proportionally if 10% more high quality animals were available. By FY 1959 the assigned program needs are expected to require 12,000 new animals per month and 22,000 animals in progress of experiment.

The need for this facility has become acute because, (1) there is a greater need for animals than the present facility can furnish, (2) the present facility is unable to furnish an adequate controlled environment, and (3) the present facility does not provide adequate isolation to prevent spread of disease. The need for experimental animals is expected to continue. The proposed facility is the most feasible and economical means of meeting the need for experimental animals from the standpoint of location and adequacy.

The new animal facility, by providing more animals (disease free), will assist the research program enough to amortize the investment in less than ten years. This saving will be effected by (1) reduction in loss of animals which now die due to disease caused by poor environment, and (2) reduction in experimental effort loss due to death of animals in the course of experimentation due to poor environment. The Walter Reed Army Institute of Research recently constructed such a new animal facility (of smaller size) and with the use of sterile technique developed "disease free" animal colonies of rats, mice, guinea pigs, hamsters and rabbits. The direct saving in animal cost amortized the construction cost in a very short time. Indirect advantages were even more important than the direct monitary saving. They were, (1) savings in time and labor of research personnel made possible by

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eliminating premature death of experimental animals; (2) better uniformity of animals permitted smaller numbers of test animals to be used; (3) the quality of research results was improved by improved quality animals; and (4) disease free animals permitted specific research procedures which were not possible on animals of lesser quality. The technique used at Walter Reed Institute of Research will be followed at this facility. In order for USNRDL to maintain standards of bio-medical research comparable with other institutions, comparable quality animals must be provided.

This project is located on Navy-owned land and it appears on the USNRDL Master Shore Station Development Plan, approved jointly by USNRDL and the SFNS Shore Station Development Board.

U. S. NAVAL RADIOLOGICAL DEFENSE LABORATORY
SAN FRANCISCO 24, CALIFORNIA

15 November 1956

SHORE STATION DEVELOPMENT PROGRAM, FY 1959

ITEM JUSTIFICATION DATA

U. S. Naval Radiological Defense Laboratory, San Francisco 24, California

10,000 Curie, Cobalt 60 Facility - 12ND 1312

Primary Category Code: 310

Proposed Authorization: $265,000

Proposed Appropriation: $265,000

SECTION I. ITEM DESCRIPTION

1. Type of construction: Permanent

2. Type of facility: New

3. Type of design: Special design

4. Physical Characteristics:

   a. Shape of building: L shaped

   b. Length in feet: 64 ft.

   c. Width in feet: 52 ft.

   d. Number of stories: 1

   e. Gross area: 2800 sq. ft.

   f. Gross cube: 92,000 cu. ft.

   g. Number of buildings: 1

   h. Heating: Yes

   i. Cooling: No

   j. Capacity: -

   k. Other: -

5. Brief Description: The irradiation facility consists of a shielding concrete enclosure to house a multi-unit isotope radiation source, manipulating equipment, monitoring and safety equipment, water pumps, a 14,000 gallon steel tank outside the building, necessary appurtenances and controls. The required room to house the facility is approximately 32' x 64' x 27' clear ceiling height with a 5-ton bridge crane to operate the full length. Additional rooms are required for bio-medical preparation and holding, instrumentation and building services. This facility is to be capable of irradiating specimens over a complete unilateral area, with the radiation source flexible in location pattern.

SECTION II. COST ESTIMATES

Code	Category Title	Unit	Quantity	Unit Cost	(In thou $) Est. Cost
Primary					
310	R&D and Test Buildings	SF	2800	71.50	200
Collateral					
310	R&D and Test Buildings			LS	25
Secondary					
612	Electricity			LS	6
822	Heat, Steam Transmission			LS	22
832	Sewer Lines			LS	3
842	Water Distribution			LS	7
852	Sidewalks and other Pavements			LS	1
890	Misc Utilities			LS	1
			TOTAL		265

Costs are based on station estimates.

SECTION III. BASIS OF REQUIREMENT

1. Quantity required: 1
2. a. Total existing quantity: 0
   b. Quantity sub-standard: 0
   c. Not existing quantity: 0

3. Construction or accomplishment underway or scheduled: 0
4. Quantity deficient: 1
5. Related items: 12ND 682 Land Excavation and Fill, First Increment
6. Statement of requirement: The Laboratory requires a radiation facility which is capable of emitting mild to strong gamma radiation over a wide area from a non-concentrated source to simulate conditions that occur during a nuclear detonation in order to study biological effects. With this facility the whole animal body can be irradiated at once as occurs during a bomb blast, instead of small areas at a time as is now necessary with existing facilities. The only existing laboratory gamma radiation source is the 2 MEV Van de Graaff accelerator. This facility, and available facilities of nearby universities are limited to very small beam output. Biological studies with the existing facilities render misleading results because biological changes occur during the long radiation time required to give the proper dosage. The proposed facility, with its ability to closely simulate actual conditions will:

   a. Permit more accurate determination of damage,
   b. Facilitate better damage criteria, based on radiac device measurements,
   c. Permit more accurate evaluation of shielding,
   d. Aid in the development of countermeasures, and
   e. Speed up the research and development program.

   If this facility is not provided, this laboratory will be limited to its present facilities and nuclear weapons' tests for obtaining vital information of nuclear radiation, and the research program will be materially retarded.

7. This project is located on Navy-owned land.

10,000 CURIE COBALT 60 FACILITY - 12ND 1312

I. REQUIREMENT

The USNRDL needs a radiation facility which is capable of irradiating biological specimens with mild to strong gamma radiation from a non-concentrated source in order to simulate conditions that occur during a nuclear detonation. With this facility the whole body can be irradiated at once, as occurs during a bomb blast, instead of small areas at a time as is now necessary with existing facilities. Experimental studies to date have been limited to medium intensity X-ray, low intensity isotope radiation, the existing 2 MEV Van de Graaff radiation, and nuclear field operations. Results to date indicate that significant biological changes occur during animal irradiation when heavy dosage is built up over long periods of time which alter the effects. It is therefore necessary to more nearly simulate the conditions that actually occur during a nuclear detonation to evaluate the true effects. This project is for the purpose of simulating the gamma radiation as it occurs in a nuclear detonation with controlled intensity in order to get more complete and accurate information on the effects, radiac device measurement, and shielding. The facility will be required in early FY 1959 in order to obtain vital information on radiation effects.

II PROJECT DESCRIPTION

The irradiation facility consists of a shielding concrete enclosure to house a multi-unit isotope radiation source which will normally be submerged under 16 feet of water, the water to act as shielding. Under these conditions experimental apparatus and specimens will be placed as desired. After operators have prepared the experiment, left the enclosure and replaced the cover, the individual isotope units are raised to the desired location and/or the shielding water is pumped out to irradiate at the desired intensity for the desired length of time. Then the isotope units are dropped to the bottom and water is replaced to permit removal by the operators. The necessary parts of the facility consist of (1) main concrete enclosure, (2) manipulating equipment, (3) platforms, etc., (4) monitoring and safety equipment, (5) water pumps, (6) a separate 14,000 gallon water tank, (7) lighting, and (8) necessary appurtenances and controls. A zinc bromide-filled window is required to observe operations within the enclosure.

The room required to house the facility is approximately 32 ft. x 64 ft. x 27 ft. clear ceiling height. A 5-ton bridge crane is required to operate the full length in order to handle shielding units, isotope shipping containers and other items. Two additional rooms approximately 15 ft. x 20 ft. each are required for bio-medical preparation and instrumentation. The structure should be permanent type, steel frame with non-combustible, insulated walls and roof. A concrete floor with asphalt tile covering is required. Heating and ventilation is required in all areas, including the irradiation facility. Neither cooling nor humidity control are required. Laboratory work benches and cabinets, including a sink, are required in each of the bio-medical and instrumentation service rooms, together with gas, hot and cold water and compressed air services. A small toilet room for convenience of operators and a building service room are required. Electrical requirements consist of ordinary lighting throughout, convenience outlets, special lighting, including underwater lights for the irradiation facility, power for the crane and ventilation system, and service to incidental and special equipment.

III PROJECT ANALYSIS

This facility is needed to simulate the gamma radiation as it occurs in a nuclear detonation in order to accurately determine the effects and develop countermeasures. This facility provides a multi-unit gamma radiation source with the capability of locating each unit to any desired horizontal

10,000 CURIE COBALT 60 FACILITY - 12ND 1312
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or vertical location in order to render the source distributed to any desired arrangement. In addition, the shielding water level may be raised or lowered as desired, for adjustability. With this completely adjustable source it will be possible to simulate nuclear detonation radiation as it is likely to be in any relative position. This facility is well adapted for laboratory use because (1) it will give essentially mono-energetic gamma radiations, (2) it will give high intensity fields over an extended volume, and (3) it will have a considerable range of intensity adjustment. The proposed types of isotopes have already been used at low intensity levels in the Laboratory. This facility is necessary to extend measurements to a progressively increasing intensity scale for shielding evaluation, bio-medical and radiac studies from a distributed or concentrated source. An outstanding feature of this facility for laboratory use is its wide range of adjustability.

This project is a vital facility in determining the effects of gamma radiation. Early approval will aid in the development of countermeasures against the effects of nuclear radiation, which is of extreme importance for military and civilian defense.

This project is contingent on completion of 12ND 682, Land Excavation and Fill, First Increment, which was sponsored by the San Francisco Naval Shipyard and which is expected to be accomplished in FY 1958.

This project appears on the USNRDL Master Shore Station Development Plan approved jointly by the USNRDL and the San Francisco Naval Shipyard Shore Station Development Board.